Claims

[c1] A method for stabilizing a gain of a gamma-ray detector for use in a downhole logging tool, the method being based on a processing of a backscatter peak of a full gamma spectrum.

[c2] The method of claim 1, the method further comprising:

determining a first rate, the first rate corresponding to gamma-rays having an energy within a first predetermined energy interval;

determining a second rate, the second rate corresponding to gamma-rays having an energy within a second predetermined energy interval,

wherein the first predetermined energy interval and the second predetermined energy interval straddle the backscatter peak.

[c3] The method of claim 2, the method further comprising:

adjusting the gain such that a ratio of the first rate and the second rate substantially equals a predetermined value.

[c4] The method of claim 2, the method further comprising:

adjusting the gain such that a difference of the first rate and the second rate multiplied by a predetermined positive coefficient substantially equals zero.

[c5] The method of claim 1, the method further comprising:

measuring a centroid position of a detected backscatter peak;

adjusting the gain such that the measured centroid position equals a reference centroid position.

[c6] The method according to claim 1, wherein the detector is intended to detect natural gamma-rays from a formation surrounding a borehole.

[c7] The method according to claim 6, wherein a gamma-ray inducing source is located in a neighborhood of the gamma-ray detector.

[c8] The method according to claim 1, wherein the detector is intended to detect neutron-induced gamma-rays.

[c9] A system for stabilizing a gain of a gamma-ray detector for use in a downhole logging tool, the system comprising:

the gamma-ray detector to detect gamma-rays;

discriminating means allowing to compare the energy of the detected gamma-rays to at least three regulation thresholds, the three regulation thresholds being located in an energy neighborhood of a backscatter peak of a full gamma spectrum;

adjusting means to adjust the gain of the gamma-ray detector.

[c10] The system of claim 9, wherein :

the discriminating means allow to determine a first rate and a second rate, the first rate and the second rate corresponding to gamma-rays having an energy respectively within a first predetermined energy interval and a second predetermined energy interval, the first predetermined energy interval and the second predetermined energy interval straddling the backscatter peak.

[c11] The system of claim 10, further comprising:

calculating means to calculate a ratio of the first rate and the second rate and to compare the ratio to a predetermined value.

[c12] The system of claim 9, wherein:

the discriminating means allow to compare the energy of the detected gamma-rays to a relatively high number of regulation thresholds so as to obtain a complete spectrum;

the system further comprises calculating means to calculate a centroid position of a detected backscatter peak of the complete spectrum and to compare the calculated centroid position to a reference centroid position.

[c13] The system of claim 9, wherein

the gamma-ray detector is located in a drilling tool;

the gamma-ray detector is intended to detect natural gamma-rays from a formation surrounding a drilled borehole.

[c14] A method for evaluating a natural gamma-ray activity within a borehole, the method comprising:

determining an interval count rate, the interval count rate corresponding to gamma-rays having an energy within a predetermined correction interval;

calculating a correction count rate from the determined interval count rate; and

using the correction count rate to evaluate the natural gamma-ray activity.

[c15] The method according to claim 14, wherein the predetermined correction interval is semi infinite above a predetermined correction threshold.

[c16] The method according to claim 15, further comprising:

measuring a total gamma count rate, the total gamma count rate corresponding to gamma-rays detected by the detector;

subtracting the correction count rate from the total gamma count rate to evaluate the natural gamma-ray activity.

[c17] The method according to claim 16, wherein the correction count rate is proportional to the determined interval count rate.

[c18] The method according to claim 14, wherein

a gamma-ray inducing source is located downhole in a neighborhood of the system; and

the gamma-ray inducing source is an high energy neutron generator.

[c19] The method according to claim 18, wherein the evaluating of the natural gamma-ray activity is performed during a drilling of the borehole.

[c20] The method according to claim 19, wherein the neutron-induced gamma-rays are due to an activation of oxygen atoms located within a drilling mud.

[c21] The method according to claim 14, further comprising stabilizing a gain of the gamma-ray detector.

[c22] The method according to claim 21, further comprising :

determining a first rate, the first rate corresponding to gamma-rays having an energy within a first predetermined energy interval;

determining a second rate, the second rate corresponding to gamma-rays having an energy within a second predetermined energy interval;

adjusting the gain to such that a value of a ratio of the first rate and the second rate substantially equals a predetermined value.

[c23] The method of claim 22, wherein the first predetermined energy interval and the second predetermined energy interval straddle a backscatter peak of a full gamma spectrum.

[c24] The method according to claim 21, further comprising:

generating calibration gamma-rays, the energy of the calibration gamma-rays being substantially equal to a well defined energy value;

using the calibration gamma-rays to stabilize the gain of the gamma-ray detector.

[c25] A system for evaluating a natural gamma-ray activity within a borehole, the system comprising:

a detector located downhole to detect gamma-rays;

at least one discriminator to allow to determine an interval count rate, the interval count rate corresponding to gamma-rays having an energy within a predetermined correction interval;

processing means to calculate a correction count rate from the determined interval count rate, the correction count rate being used to evaluate the natural gamma-ray activity.

[c26] The system according to claim 25, wherein the predetermined correction interval is semi infinite above a predetermined correction threshold.

[c27] The system according to claim 26,

wherein the at least one discriminator allows to determine a first rate and a second rate, the first rate and the second rate corresponding to gamma-rays having an energy respectively within a first predetermined energy interval and a second predetermined energy interval; the system further comprising

calculating means to calculate a ratio of the first rate and the second rate and to compare the ratio to a predetermined value;

adjusting means to adjust a gain of the gamma-ray detector according to a result of the comparing.

[c28] The system according to claim 25, wherein

a gamma-ray inducing source is located downhole near the system;

the gamma-ray inducing source is an high energy neutron generator.

[c29] The system according to claim 28, wherein the detector is located in a drilling tool.

[c30] The system according to claim 29, wherein the detector detects neutron-induced gamma-rays, the neutron-induced gamma-rays being due to an activation of oxygen atoms located in a drilling mud by high energy neutrons.

[c31] The system according to claims 25, further comprising:

a shield located at a rear side of a crystal of the gamma-ray detector to reduce the detecting of gamma-rays coming from the rear side.

[c32] The system according to claims 31, further comprising:

a collar surrounding the crystal, the collar having a recess on a front side of the crystal to improve a transmission of gamma-rays coming from the front side.